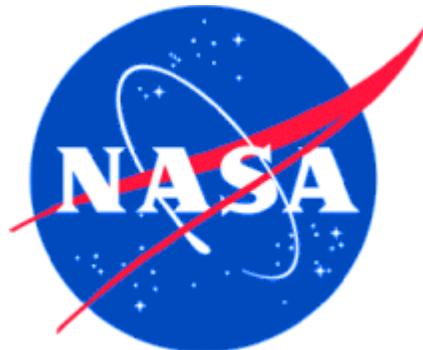

Reuse Enablement System (RES) Test Plan

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January 29, 2010



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1. Executive Summary

One of the primary goals of the Software Reuse Working Group, one of the NASA Earth Science Data Systems (ESDS) Working Groups, is to save NASA and its partners time and money by driving down the cost and time of system development and by reducing or eliminating expensive redundancy and duplication in system development. To this end, the development of a Reuse Enablement System (RES) is proposed as a way to provide members of the Earth science software development community with easy access to reusable software assets. Studies have been conducted to demonstrate the need for such a system and to recommend a method for creating the proposed RES.

As the number of Earth observing instruments and captured data volume increase, so do the complexity and costs associated with software development in support of data transformation, analysis, processing, management, and end-product implementation. Software development costs can be high and the time needed to develop new applications can be considerable. The Earth Observing missions have aided in amplifying knowledge of the Earth system by generating many useful scientific data. To maximize the use of these data, the Earth science community must be able to spend less time, money, and effort on software development and more on scientific work. Reusing software, including open source software, has many benefits such as increased productivity, reduced schedule, and improved quality. However, realizing these benefits for Earth science has been challenging.

Our survey of the Earth science community has indicated that lack of a centralized domain-specific software repository or catalog system addressing the needs of the Earth science community is a major barrier to software reuse within the community.¹ A trade study has been conducted to examine a variety of sites as potential platforms to enable software reuse for the Earth science community. The Reuse Enablement System (RES) Trade Study (dated November 17, 2005) revealed that none of the evaluated repository or catalog systems can adequately satisfy the needs of the community. Based on the results of the trade study, it is recommended that NASA should provide the necessary support for a reuse enablement system dedicated to the Earth science community that could be expanded to include the space science community. In support of the recommendation, technology options for a reuse enablement system have been evaluated in the Reuse Enablement System (RES) Architecture Study (revised February 14, 2008) and the results show that using the XOOPS content management system with appropriate modifications is the best option for creating a Reuse Enablement System that will provide the community of Earth science software developers with reusable software assets.

Using the Reuse Enablement System (RES) Requirements (revised May 7, 2007), this Test Plan has been developed to provide the means for testing and verifying that any reuse enablement system built according to the Working Group's recommendations meets the requirements for such a system. This document provides a brief review of the RES requirements, pre-requisites for testing, and functional test cases for testing the requirements.

¹ See the Proceedings of the 2006 IEEE International Geoscience and Remote Sensing Symposium, vol. 6, pp.2880-2883, "Software Reuse Within the Earth Science Community" by Marshall et al.

2. Background

To address the technical issues required to enable and facilitate reuse of software assets within NASA's Earth Science Enterprise (ESE), the Software Reuse Working Group was created as part of the NASA Earth Science Data Systems (ESDS) Working Groups. This was the result of one of the recommendations from the NASA HQ-commissioned Strategic Evolution of ESE Data Systems (SEEDS) Study; the SEEDS activity became the ESDS Working Group activity. The Software Reuse Working Group was chartered to oversee the process that will maximize the reuse potential of such software components in order to: (1) drive down the cost and time of system development and reduce/eliminate unnecessary duplication of effort; (2) increase flexibility and responsiveness relative to Earth science community needs and technological opportunities; and (3) increase effective and accountable community participation.

These objectives, the goals of the Working Group, include:

- recommending and supporting activities that help increase awareness of available software components,
- increasing awareness of the value of reuse, provide needed processes and mechanisms,
- disseminating successful reuse strategies,
- and addressing related intellectual property and policy issues.

In the process of fostering greater software reuse across the Earth science community, a wide variety of approaches have been considered to help meet differing needs and priorities. One such approach has been the creation of the Software Reuse Working Group portal web site (<http://www.esdswg.org/softwarereuse>). The portal contains information on reusable assets, resources such as events, publications, open source software in general, and funding opportunities, as well as information about activities relevant to reuse. Thus, it provides members of the community with a central location for finding information about software reuse.

The goal of these software reuse activities is to encourage Earth science software developers to make use of existing software assets (including open source software) to provide them with a convenient way to locate and obtain such assets, and to encourage them to develop products for reuse by others. The process of creating a new software product by reusing existing components can be likened to the building of a house. The consumers will be able to buy a completed house, but it is the builders who create the house from a variety of pre-fabricated components such as the frame, windows, and plumbing. Alternatively, consumers may get parts to build their own house, if these parts are well packaged for use directly by the consumers. By using tools, parts, and methods that have been tested over time and are known to work well, it becomes easier and more efficient for them to build the house. Likewise, if software developers can make use of existing software components, it will be easier and more efficient for them to create new products. This is more generally known as the process and concept of software architecture, and leveraging this notion for Earth science data assets is one of the main goals of the WG.

Software released under an open source license is publicly available and other software developers can read, modify, and redistribute the source code. Increased use of open source licensing is recommended as an important enabler for software reuse. The licensing mechanism of open source, compared to traditional software licensing, eliminates a significant barrier to code sharing and thus helps to encourage and promote reuse. However, open source licensing is not appropriate for all types of software and traditionally licensed software can still be reused. Therefore, an effective reuse program has to accommodate both open source and non-open source software.

To facilitate the software reuse process, developers need to be able to easily locate and evaluate the available reusable artifacts. These were identified as important factors in a survey (OMB #2700-0117) that was conducted to assess the reuse practices of the Earth science community. See Appendix A for additional information about the survey.² The results showed that when people did not reuse software, the primary reasons were because they did not know where to look and they did not know such reusable software existed. In addition, the survey revealed that a catalog or repository for reusable artifacts is the best means of increasing software reuse within the Earth science community. For this reason, the reusable artifacts should be classified and made available through an appropriate reuse enablement system (e.g., libraries, catalogs, repositories) that can facilitate searching and indexing. These systems are an essential ingredient in transforming ad-hoc reuse (which is largely dependent on personal knowledge and word of mouth dissemination of information about the availability of reusable artifacts) to systematic reuse as an integral part of the software development process.

To achieve the above goal, the Software Reuse Working Group was tasked to research and evaluate existing software catalog and repository systems within NASA, specifically the Global Change Master Directory (GCMD) and the NASA Open Source Agreement site, as possible alternatives to: (1) hosting software assets for the Earth science community and/or (2) developing an Earth science Reuse Enablement System by using existing enablement system reusable infrastructure software components. See Appendix B for the report containing the original recommendation and the response by NASA HQ. These sites as well as other NASA sites and a variety of non-NASA sites performing similar roles were examined and reviewed in a trade study, the results of which showed that none of the existing systems perform the role of providing software developers in the Earth science community with the types of reusable assets they find most useful (see the Reuse Enablement System (RES) Trade Study for more details). It is important to note that this study focuses on the needs of the Earth science community and that the resulting recommendations are not trying to supplant the many accessible open source sites that currently provide registries of general-purpose software.

With the need for a new system identified, a study investigated different architectures and methods for creating a Reuse Enablement System that would meet the reuse needs of the Earth science software development community. A number of software packages and systems were examined for their ability to meet the Working Group's requirements, as presented in the Reuse Enablement System (RES) Requirements document dated May 7, 2007. This was done through both creating prototypes of systems and examining existing systems that use the same software packages and systems. The results of this study showed that using the XOOBS open source content management system with

² See also the Proceedings of the 2004 IEEE International Geoscience and Remote Sensing Symposium, vol. 3, pp. 2196-2199, "Strategies for Enabling Software Reuse within the Earth Science Community" by Samadi et al. for preliminary results from an earlier, almost identical survey or the Proceedings of the 2006 IEEE International Geoscience and Remote Sensing Symposium, vol. 6, pp.2880-2883, "Software Reuse Within the Earth Science Community" by Marshall et al. for initial results from the most recent survey.

appropriate modifications is the best option for creating a Reuse Enablement System that will provide the community of Earth science software developers with reusable software assets (see the Reuse Enablement System (RES) Architecture Study for more details).

This document provides a summary of the formal requirements for a Reuse Enablement System (RES), followed by test procedures for each formal requirement. The tests described here assume that the RES system is created based on the XOOFS content management, as recommended by the results of the Architecture Study, and has been modified and configured to serve as the RES. These and other related assumptions are documented at the beginning of Section 5 as pre-requisites for testing.

3. *Applicable and Supporting Documents*

- Reuse Enablement System (RES) Trade Study (November 17, 2005)
Author: NASA ESDS Software Reuse WG
- Reuse Enablement System (RES) Use Cases (August 10, 2006)
Author: NASA ESDS Software Reuse WG
- Reuse Enablement System (RES) Requirements (September 18, 2006, revised May 7, 2007)
Author: NASA ESDS Software Reuse WG
- Reuse Enablement System (RES) Architecture Study (July 23, 2007, revised February 14, 2008)
Author: NASA ESDS Software Reuse WG

4. *Requirements Summary*

Description/Purpose of Requirements

The primary function of a Reuse Enablement System (RES) is to facilitate the distribution and reuse of software development artifacts across the Earth science community, with possible extension to space science. The reusable artifacts supported by the system will include software components and other digital artifacts used in the software development process. It must also have the ability to function as both a catalog and a repository, the main difference between the two being that a catalog stores links to artifacts while a repository stores the actual artifacts themselves. By being able to perform both tasks, the RES provides more options to the user and is able to go beyond what either a catalog or a repository can do alone.

The primary users for the Reuse Enablement System are NASA-funded software developers within the Earth science community. The other category of user is researchers

and scientists in various organizations who may be involved with NASA projects. Others are academic scientists or members of research communities. In some cases, the users are also asset providers, implementing software assets and delivering them to the RES for dissemination.

The Software Reuse Working Group conducted a workshop to identify the functional requirements needed for a software Reuse Enablement System (RES) supporting the Earth science community. Several members of the Working Group participated in this workshop and helped draft the initial set of use cases that were developed into requirements. Over a period of several months, these requirements were refined through weekly and monthly telecons and finalized during a review at the October 2004 Data Systems Working Group meeting. The result of this work identified a number of requirements in the following areas: general, search, user registration, asset usage, asset submission, content management, and system administration. These are described in detail in Appendix C.

The general requirements include the kind of features that all systems are expected to exhibit, such as supporting remote access through standard Internet browsers and allowing administrators to generate reports including metrics. It also includes non-functional requirements such as the system being in the Earth science domain, providing the types of assets that are most useful to software developers, and providing a method for appraising the submitted assets for quality control purposes. The focus on the Earth science domain was considered important because it enables the repository to have an asset classification system specific to the needs of the target audience and Earth science assets would not be obscured by large numbers of non-relevant artifacts. The functional requirements can be viewed in the larger categories as noted above (see Appendix C) or in smaller categories based on the specific functions they provide, the use cases for the system.³ For example, one obvious required function is that the system shall allow users to acquire an asset from the system.

The requirements study was conducted for several months in 2006 to review the proposed descriptive requirements and to create formal requirement statements from these requirements. Several members helped draft the initial statements, which were then refined through weekly and monthly telecons, being finalized at one of the monthly telecons. The formalized requirements are given in the following section.

Statement of Requirements

The following are the titles of the formal requirements for the Reuse Enablement System. See Appendix D for a glossary of terms and additional definitions. Descriptions of the requirements and additional details about the development of these requirements can be found in the Reuse Enablement System (RES) Requirements document.

Requirement Number and Title
<i>1 – Users and User Information</i>
<i>1.1 – Support for User Types</i>
R1.1.1 – Support for Consumer User
R1.1.2 – Support for Provider User
R1.1.3 – Support for Administrator User

³ <http://www.sciencedatasystems.org/reuse/default.aspx> -- General WG Documents, Reuse Enablement System (RES), Support and Enablement, Reuse Enablement System Use Cases

R1.1.4 – Support for Content Manager User
<i>1.2 – User Information Storage</i>
R1.2.1 – Storage of Common User Information
R1.2.2 – Storage of Provider Information
<i>1.3 – User Interface</i>
R1.3.1 – User Profile Management
R1.3.2 – User Request Account Deletion
<i>2 – Asset Storage and Management</i>
<i>2.1 – Asset Information Storage</i>
R2.1.1 – Storage of Asset Information
R2.1.2 – Storage of Asset Resources
R2.1.3 – Storage of Asset Versions
R2.1.4 – Scanning of Asset Uploads
<i>2.2 – Asset Discovery</i>
R2.2.1 – Display Alphabetical Listing of Assets
R2.2.2 – Provide Search for Assets
R2.2.3 – Display Hierarchical Navigation of Assets
<i>2.3 – Asset Management</i>
R2.3.1 – Provider Registration of New Assets
R2.3.2 – Provider Modification of Assets
R2.3.3 – Provider Approval of Asset Modifications
R2.3.4 – Provider Request for Asset Removal
R2.3.5 – Provider Categorization of Assets
<i>2.4 – Asset Feedback</i>
R2.4.1 – Collection of Comments About Assets
R2.4.2 – Collection of Quantitative Feedback
R2.4.3 – User Registration of Asset Usage
R2.4.4 – Feedback by Contacting Providers
R2.4.5 – Display Feedback
<i>2.5 – Asset Metrics and Reports</i>
R2.5.1 – Collect Number of Downloads
R2.5.2 – Collect Number of External Links Accessed
R2.5.3 – Collect Number of Registered Users for Assets
R2.5.4 – Summarize Ratings from Quantitative Feedback
<i>2.6 – Asset Access Control</i>
R2.6.1 – Limit Access of Certain Users from Certain Assets
<i>3 – Send and Manage Notifications</i>
<i>3.1 – Send Notifications for Asset Events</i>
R3.1.1 – Send Notification on Modification of Asset
R3.1.2 – Send Notification on Submission of New Feedback
<i>3.2 – Send Notifications for System Events</i>
R3.2.1 – Send Administrative Notification for Asset Information
R3.2.2 – Send Administrative Notification for System Information
<i>3.2 – Notification Management</i>

R3.2.1 – User Addition of Notifications for Assets
R3.2.2 – User Removal of Notifications
<i>4 – System Operations</i>
<i>4.1 – System Feedback</i>
R4.1.1 – Collection of System Problems
R4.1.2 – Collection of Suggestions
R4.1.3 – Feedback by Contacting Administrators
<i>4.2 – System Policies Compliance, Security, and Privacy</i>
R4.2.1 – Verification of Provider Information
R4.2.2 – Verification of Provider through Secondary Method or Contact
R4.2.3 – Security of Sensitive Transmitted Information
R4.2.4 – Security of Stored Information
R4.2.5 – Deletion of Users for Policy Enforcement
R4.2.6 – Protection of Private Information
R4.2.7 – Compliance with other Technical, Accessibility, and Security Requirements
R4.2.8 – Policies Availability to Users
<i>4.3 – Repository and Catalog</i>
R4.3.1 – Function as a Repository
R4.3.2 – Function as a Catalog
R4.3.3 – Selection of System Behavior by Provider
R4.3.4 – Enforcement of Asset Storage Limit
<i>4.4 – Asset Cleanup</i>
R4.4.1 – Asset Deprecation by Content Managers
R4.4.2 – Asset Removal by Administrators
<i>4.5 – Data Integrity</i>
R4.5.1 – Verification of Data by Providers

5. Functional Test Cases

Prerequisites

The following conditions are assumed to be true in order to complete the following tests.

- The RES under test has been created using the XOOPS content management system, appropriately modified, as recommended by the Reuse Enablement System (RES) Architecture Study
- To provide functionality beyond the base XOOPS system, the following modules have been installed and configured:
 - PD-Downloads (v1.2 or later)
 - Liaise (v1.26 or later)
- The RES is pre-populated with some number of assets (10 to 20 should be sufficient for testing purposes).

- One or more virus scanners have been installed and configured to work with the XOOPS upload function.
- The tester is able to access the RES web site without logging in to an account on the system (anonymous user).
- One or more Consumer (Registered User) accounts exist, and the tester is able to log on to the RES web site using these accounts.
- One or more Provider accounts exist, and the tester is able to log on to the RES web site using these accounts.
- One or more Content Manager accounts exist, and the tester is able to log on to the RES web site using these accounts.
- One or more Administrator (Webmaster) accounts exist, and the tester is able to log on to the RES web site using these accounts.

If any of these are not true, please contact the ESDS WG or the current RES support staff for assistance. Note that other modules may be installed in addition to the ones listed above in order to provide additional features for the RES. For example, Captcha for verifying registrations helps avoid automated registrations by computers, Waiting Contents Extensible provides information about new and changed items that is useful for administrators of the RES, and Protector offers additional security features for XOOPS. All of these can be useful for running and administering the RES, and may be installed and configured on the RES in test. However, these and other modules are optional, and are not required for the following tests.

The following test case/procedure sections are formatted as follows: a description of the requirement from the Reuse Enablement System (RES) Requirements document is followed by a short sentence on the type of test being performed, and then the test is described in a set of steps to be followed.

Requirement 1.1.1 – Support for Consumer User

The system shall provide the ability for users called Consumers to download or otherwise access and use locally stored assets.

This requirement is tested by inspection.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Groups option.
5. Select the Modify option for the Registered Users group.
6. Verify that the Registered Users have:

- a. No System admin rights
- b. No Module admin rights
- c. All Module Access rights
- d. All Block Access Rights **except** Waiting Contents and Waiting Contents Ext.

Requirement 1.1.2 – Support for Provider User

The system shall provide the ability for users called Providers to submit new assets or asset modifications. Providers also have the same rights and privileges as Consumers.

This requirement is tested by inspection.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Groups option.
5. Select the Modify option for the Providers group.
6. Verify that the Providers have:
 - a. No System admin rights
 - b. No Module admin rights
 - c. All Module Access rights
 - d. All Block Access Rights **except** Waiting Contents and Waiting Contents Ext.
7. Select the PD-Downloads module.
8. Select Preferences from the text menu at the top.
9. Verify that Providers are selected (highlighted) under Download Submission.

Requirement 1.1.3 – Support for Administrator User

The system shall facilitate the ability for administrators to approve new users, manage assets, and approve new submissions, modifications, and deletions. Administrators also have the same rights and privileges as Providers.

This requirement is tested by inspection.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Groups option.
5. Select the Modify option for the Administrators group.
6. Verify that the Administrators have all rights in all categories.

Requirement 1.1.4 – Support for Content Manager User

The system shall provide the ability for users called Content Managers to review and approve content submitted to the system. Content Managers may also be one of the other user types and will have the same rights and privileges as that user type.

This requirement is tested by inspection.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Groups option.
5. Select the Modify option for the Content Managers group.
6. Verify that the Content Managers have:
 - a. System admin rights for only Comments and Find Users
 - b. Module admin rights for only the Downloads module
 - c. All Module Access rights
 - d. All Block Access Rights.

Requirement 1.2.1 – Storage of Common User Information

The system shall be capable of storing information for each user, minimally a user name, a password, and a form of contact information (e.g., an e-mail address).

This requirement is tested by test.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Edit Users option.
5. Choose an account by user name in the pull-down menu.
6. Click the Go! button.
7. Verify that the system is capable of storing a user name (chosen above), a password (through the option to set it), and an e-mail address as contact information.

Requirement 1.2.2 – Storage of Provider Information

The system shall be capable of storing information for Providers to indicate their organizational affiliation and area of expertise, as well as the information listed in Requirement 1.2.1.

This requirement is tested by test. Passing the test for Requirement 1.2.1 above is a prerequisite to passing this test, as the Provider information verified here must be available **in addition to** the common user information tested and verified in Requirement 1.2.1.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Edit Users option.
5. Choose an account by user name in the pull-down menu.
6. Click the Go! button.
7. Verify that the system is capable of storing:
 - a. An organizational affiliation
 - b. An area of expertise

Note that while available fields may not be labeled specifically “Affiliation” and “Area of Expertise”, this information should be able to provided in other fields, for example, Occupation and Extra Info, respectively.

Requirement 1.3.1 – User Profile Management

The system shall provide a mechanism by which registered users can modify their registered information.

This requirement is tested by inspection.

1. Log on to the RES as a Consumer (Registered User).
2. Go to the Edit Account section.
3. Change any information for this account.
4. Click the Save Changes button.
5. Verify that the information was changed.

Requirement 1.3.2 – User Request Account Deletion

The system shall provide users with the ability to request account deletion.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Click View Account.
3. Click Delete Account.
4. Click Submit.
5. Log on to the RES as an Administrator.
6. Go to the Administration Menu.
7. Select the System Administration module.
8. Select the Find Users option.
9. Click the Submit button.
10. Verify that the user account just deleted no longer exists in the system.

Requirement 2.1.1 – Storage of Asset Information

The system shall require information to be stored for each asset, minimally a title, a description, one or more categories, one or more keywords, and one or more resources (see Requirement 2.1.2).

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section.
3. Click on the Submit option.
4. Verify that uploads require:
 - a. A title
 - b. A description
 - c. One or more categories
 - d. One or more keywords
 - e. One or more resources (either uploaded or linked to)

Requirement 2.1.2 – Storage of Asset Resources

The system shall require that an asset resource be either uploaded and locally stored or externally stored at another Uniform Resource Indicator (URI).

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Click on the Submit option.
4. Verify that uploads require a resource to be provided either by uploading a file to the system or by providing a link to an externally hosted resource.

Requirement 2.1.3 – Storage of Asset Versions

The system shall be capable of storing more than one version of an asset.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Click My Uploads.
4. Click Upload New Version for one of the listed assets.
5. Enter appropriate information for the following form fields:
 - a. Download Title
 - b. Either Link to Download or Upload File
 - c. Category
 - d. Description (including keywords)
 - e. Version
6. Click the Submit button.
7. Log out.
8. Log in as an Administrator.
9. Under Downloads on the left menu, click Waitings.
10. Click Approve next to the new item.
11. Click Yes when asked if you would like to approve without examining.
12. Log out.
13. Log in as a Registered User.
14. Go to the Downloads section of the site.
15. Locate the asset selected in step 4.
16. Verify that there is another version listed.

Requirement 2.1.4 – Scanning of Asset Uploads

The system shall provide the capability to enable virus scanning of uploaded files.

This requirement is tested by inspection.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.

3. Click on the Submit option.
4. Click the I Agree button.
5. Enter appropriate information for the following form fields:
 - a. Download Title
 - b. Either Link to Download or Upload File
 - c. Category
 - d. Description
 - e. Version
6. Click the Submit button.
7. Log onto the server which runs the virus scanner.
8. Examine the virus scanner log file for a new line containing the scan results.

Requirement 2.2.1 – Display Alphabetical Listing of Assets

The system shall provide an alphabetical listing, based on asset title, to Consumers.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Verify that the “Browse Downloads by alphabetical listing” option is available.
4. Select a number or letter from the alphabetical listing option. This step may need to be repeated in order to find a number/letter with assets.
5. Verify that the assets displayed start with the selected number/letter and are displayed in alphabetical order.

Requirement 2.2.2 – Provide Search for Assets

The system shall provide Consumers with the ability to search assets by title, description, and keyword.

This requirement is tested by test.

1. Visit the RES web site (logging in is not required).

2. Go to the Downloads section of the site.
3. Locate one or more assets in the download section.
4. Make note of the title, description, and keyword(s) for the selected asset(s).
5. Enter part of an asset title in the Search RES box.
6. Click the Go button.
7. Verify that one or more assets are correctly located by the search engine.
8. Enter part of an asset description in the Search RES box.
9. Click the Go button.
10. Verify that one or more assets are correctly located by the search engine.
11. Enter a keyword in the Search RES box.
12. Click the Go button.
13. Verify that one or more assets are correctly located by the search engine.

Requirement 2.2.3 – Display Hierarchical Navigation of Assets

The system shall provide Consumers with one or more hierarchically categorized listings of assets.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Verify that the “Main Category Listings” option displaying a set of hierarchically arranged folders is available.

Requirement 2.3.1 – Provider Registration of New Assets

The system shall provide a method for Providers to submit a new asset, with Content Manager approval.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.

3. Click on the Submit option.
4. Click the I Agree button.
5. Enter appropriate information for the following form fields:
 - a. Download Title
 - b. Either Link to Download or Upload File
 - c. Category
 - d. Description (including keywords)
 - e. Version.
6. Click the Submit button.
7. Verify that a message is displayed indicating the asset must be approved.
8. Log off of the RES.
9. Log on to the RES as a Content Manager.
10. Go to the Administration Menu.
11. Select the PD-Downloads module.
12. Click on the Submitted link to see newly submitted assets.
13. Click the approve icon, displayed as a check mark in a box.
14. Click the Submit button to confirm the approval.
15. Return to the home page.
16. Go to the Downloads section of the site.
17. Navigate the folder hierarchy to the category selected in step 5.
18. Verify that the new asset is available.

Note: At step 13, the Content Manager may choose to view and possibly edit the asset before approving it. This is not necessary for the test, which only needs to show that Content Manager approval of submitted assets is required.

Requirement 2.3.2 – Provider Modification of Asset

The system shall provide a method for Providers to submit modifications to existing asset metadata and resources.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Click the My Uploads link.
4. Choose one of the available assets submitted by the Provider account currently logged in.
5. Click the View Full Details link.
6. Click the Modify link.
7. Click the I Agree button.
8. Modify one or more fields for the asset.
9. Click the Submit button. A confirmation will appear and you will be returned to the Downloads section of the site.
10. Click the My Uploads link.
11. Select the same asset chosen in step 4.
12. Click the View Full Details link.
13. Verify that the changes made in step 8 have been made.

Requirement 2.3.3 – Provider Approval of Asset Modifications

The Provider of an asset will be the authority for approving modifications to its existing asset metadata and resources.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Locate an asset in the download section that was submitted by another Provider. Make note of this (original) Provider.
4. Click on View Full Details.
5. Click the Modify link.
6. Click the I Agree button.
7. Modify one or more fields for the asset.

8. Click the Submit button. A confirmation will appear and you will be returned to the Downloads section of the site.
9. Log out of the RES.
10. Log on to the RES as the original Provider of the asset selected in step 3.
11. Go to the Downloads section of the site.
12. Locate the same asset selected in step 3.
13. Verify that the original Provider has the option to accept or reject the changes made by a different Provider (the one selected in step 1).

Requirement 2.3.4 – Provider Request for Asset Removal

The system shall provide a method for Providers to submit an asset removal request.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the My Uploads section of the site.
3. Click the Request Removal of an Asset Link.
4. Complete the form.
5. Submit the form.
6. Log on to the RES as an Administrator.
7. Go to the Inbox
8. Verify that the information submitted with the form was sent to the Administrator.

Requirement 2.3.5 – Provider Categorization Asset

The system shall provide a method for Providers to submit a modification for an asset category.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Select any folder with assets.

4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset that was submitted by the Provider account currently logged in.
6. Select the View Full Details option.
7. Select the Modify option.
8. Click the I Agree button.
9. Change the assets category by selecting a new one from the drop-down menu.
10. Click the Submit button.
11. Select the folder corresponding to the original category for the asset.
12. Verify that the asset is no longer located in this old category.
13. Select the folder corresponding to the new category for the asset, as chosen in step 9.
14. Verify that the asset is now located in this new category.

Requirement 2.4.1 – Collection of Comments about Assets

The system shall provide the ability to leave textual comments for each asset.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.
6. Select the Comments link near the bottom of the asset's listing.
7. Click the Post Comment button.
8. Enter a comment in the Message field.
9. Click the Post Comment button.
10. Verify that the text comment was posted in the Comments section for the selected asset.

Requirement 2.4.2 – Collection of Quantitative Feedback

The system shall provide the ability to leave subjective but quantitative ratings for each asset.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.
6. Select the Rate Resource link near the bottom of the asset's listing.
7. Select a rating from the pull-down menu.
8. Click the Rate button.
9. Locate the same asset in the download section again.
10. Verify that the asset's rating has been updated for the rating just provided.

Requirement 2.4.3 – User Registration of Asset Usage

The system shall provide the ability for users to register usage of a particular asset within the system.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any one of the following:
 - a. Popularity from the text menu at the top of the page
 - b. Rating from the text menu at the top of the page
 - c. Popular from the left side menu
 - d. Top Rated from the left side menu
4. Click the link "which files you are currently reusing" in the gray box near the top of the page.

5. Check boxes for assets this Consumer account is reusing.
6. Uncheck boxes for assets this Consumer account is not reusing.
7. Click the Submit button.
8. Verify that the Active Users count for the asset(s) changed have been adjusted appropriately.

Requirement 2.4.4 – Feedback by Contacting Providers

The system shall provide the capability for users to directly contact a Provider, subject to that Provider's agreement.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.
6. Next to "Submitter:", click on the user's name.
7. Verify that an e-mail address for the asset Provider is available.

Note: Since every user has the ability to show or hide his/her e-mail address from other users, the presence of an e-mail address in a Provider's profile when viewed by another user demonstrates the Provider's agreement to be contacted directly at this address.

Requirement 2.4.5 – Display Feedback

The system shall display to Consumers previously collected feedback.

This requirement is tested by test.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.

6. Click the View Full Details link for the chosen asset.
7. Verify that the detailed information page for the asset displays the following information:
 - a. Comments
 - b. Ratings

Requirement 2.5.1 – Collect Number of Downloads

The system shall collect information on how many times a locally stored asset is downloaded.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Select an asset for which a downloadable file is available.
6. Verify that a number is displayed next to Downloads in the file information.

Requirement 2.5.2 – Collect Number of External Links Accessed

The system shall collect information on how many times an externally stored asset is accessed.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Select an asset for which a link to an external site containing the asset is available.
6. Verify that a number is displayed next to Downloads in the file information.

Requirement 2.5.3 – Collect Number of Registered Users for Assets

The system shall collect information on how many users have registered usage of a particular asset.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Select any asset.
6. Verify that a number is displayed next to Active Users in the file information.

Requirement 2.5.4 – Summarize Ratings from Quantitative Feedback

The system shall collect and summarize quantitative consumer feedback.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.
6. Verify that the information displayed includes:
 - a. The number of votes for an asset
 - b. The rating for the asset

Notes: If necessary, multiple Consumer and/or Provider accounts can be used to rate an asset as described for Requirement 2.4.2 above. With these different ratings known, the average can be calculated, and compared against the rating displayed by the RES to verify that the system correctly summarizes the quantitative feedback received.

Alternatively, the tester can log on to the RES as an Administrator, go to the Administration Menu, select PD-Downloads, then Vote Data. The information here can

together with the displayed rating on the asset's page can be used to verify the correct averaging of all ratings given for the asset.

Requirement 2.6.1 – Limit Access of Certain Users from Certain Assets

The system shall have the capability of limiting the access of certain assets to certain user groups in accordance with system policies.

This requirement is tested by test.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the PD-Downloads module.
4. Click the Permissions link.
5. Under File Permissions, select one or more assets, and note the current permissions.
6. For each user type – Anonymous, Consumer, Provider, Content Manager, and Webmaster:
 - a. Log on to the RES as the user type. (Anonymous users do not need to log in.)
 - b. Go to the Downloads section.
 - c. Locate the selected asset(s) by any means.
 - d. Verify that the current user type can or cannot access the selected asset(s) according to the permissions noted in step 5.
7. Repeat steps 1–4.
8. Under File Permissions, change the permissions on one or more of the same assets selected in step 5.
9. For each user type – Anonymous, Consumer, Provider, Content Manager, and Webmaster:
 - a. Log on to the RES as the user type. (Anonymous users do not need to log in.)
 - b. Go to the Downloads section.
 - c. Locate the selected asset(s) by any means.
 - d. Verify that the current user type can or cannot access the selected asset(s) according to the new permissions created in step 8.

Requirement 3.1.1 – Send Notification on Modification of Asset

The system shall have the capability of sending notifications when an asset metadata or resource has been modified.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Select any asset and note the Provider of the asset.
6. Click on View Full Details.
7. At the bottom of the page under Notification Options, check the box for “Notify me when a new comment is posted for this item.” in the File category.
8. Set the notification method to private message, if it is not already set to this option.
9. Click the Update Now button.
10. Log out of the RES.
11. Log on to the RES as the Provider of the asset selected in step 5.
12. Go to the Downloads section of the site.
13. Select any folder with assets.
14. If applicable, select any sub-folder with assets (multiple times if necessary).
15. Select the same asset chosen in step 5.
16. Click the View Full Details link.
17. Click the Modify link.
18. Click the I Agree button.
19. Modify one or more fields for the asset.
20. Click the Submit button. A confirmation will appear and you will be returned to the Downloads section of the site.
21. Log out of the RES.

22. Log on to the RES using the same Consumer account as in step 1.
23. Go to the Inbox.
24. Verify that there is a message about the asset modification (created in step 19).

Requirement 3.1.2 – Send Notification on Submission of New Feedback

The system shall have the capability of sending notifications when new feedback is left for an asset.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Select any asset.
6. Click on View Full Details.
7. At the bottom of the page under Notification Options, check the box for “Notify me when a new comment is posted for this item.” in the File category.
8. Set the notification method to private message, if it is not already set to this option.
9. Click the Update Now button.
10. Log out of the RES.
11. Log on to the RES with another account. Any type that can leave a comment will work for the purposes of this test.
12. Go to the Downloads section of the site.
13. Select any folder with assets.
14. If applicable, select any sub-folder with assets (multiple times if necessary).
15. Select the same asset chosen in step 5.
16. Click on Comments under the asset description.
17. Click the Post Comment button.
18. Write a comment in the Message field.

19. Click the Post Comment button.
20. Log out of the RES.
21. Log on to the RES using the same Consumer account as in step 1.
22. Go to the Inbox.
23. Verify that there is a message about the new comment (posted in step 19).

Note: After step 23, the tester can select the message, and click the link in the message to view the newly posted comment.

Requirement 3.2.1 – Send Administrative Notification for Asset Information

The system shall have the capability of sending administrative notifications concerning an asset.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to Edit Account.
3. Click the radio button for “Yes” next to “Receive occasional email notices?”
4. Click the Save Changes button.
5. Log out of the RES.
6. Log on to the RES as an Administrator.
7. Go to the Administration Menu.
8. Select the System Administration module.
9. Select the Mail Users option.
10. Highlight Registered Users in “Group is”.
11. Check the box next to “Send message only to users that accept notification messages (optional)”.
12. Fill in a subject that indicates this message is for an asset notification.
13. Fill in a body that provides information about the asset.
14. Under “Send to”, uncheck “Email” and check “Private Message”.
15. Click the Send button.

16. Log out of the RES.
17. Log on to the RES using the same Consumer account as in step 1.
18. Go to the Inbox.
19. Verify that there is a message from the Administrator (sent in step 15).

Requirement 3.2.2 – Send Administrative Notification for System Information

The system shall have the capability of sending administrative notifications concerning the system.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to Edit Account.
3. Click the radio button for “Yes” next to “Receive occasional email notices?”
4. Click the Save Changes button.
5. Log out of the RES.
6. Log on to the RES as an Administrator.
7. Go to the Administration Menu.
8. Select the System Administration module.
9. Select the Mail Users option.
10. Highlight Registered Users in “Group is”.
11. Check the box next to “Send message only to users that accept notification messages (optional)”.
12. Fill in a subject that indicates this message is for a system notification.
13. Fill in a body that provides information about the system.
14. Under “Send to”, uncheck “Email” and check “Private Message”.
15. Click the Send button.
16. Log out of the RES.
17. Log on to the RES using the same Consumer account as in step 1.
18. Go to the Inbox.

19. Verify that there is a message from the Administrator (sent in step 15).

Requirement 3.3.1 – User Addition of Notifications for Assets

The system shall provide users with the capability of receiving notifications for each asset.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Downloads section of the site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Choose an available asset.
6. Click the View Full Details link for the chosen asset.
7. Select the checkbox for Notify me when a new comment is posted for this item.
8. Select the checkbox for Notify me when a new file is posted to the current category.
9. Click the Update Now button.
10. Go to the Notifications section (top menu).
11. Verify that the selected notifications are listed.

Requirement 3.3.2 – User Removal of Notifications

The system shall provide users with the capability of removing themselves from notifications.

This requirement is tested by test.

1. Log on to the RES as a Consumer.
2. Go to the Notifications section (top menu).
3. Select one or more notification events from the list.
4. Click the Delete button.
5. Verify that the notifications are no longer listed.

Requirement 4.1.1 – Collection of System Problems

The system shall be capable of collecting bug reports and problems about the operation of the system.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the Contact Us section of the site.
3. Complete the form.
4. Submit the form.
5. Log on to the RES as an Administrator.
6. Go to the Inbox
7. Verify that the information submitted with the form was sent to the Administrator.

Requirement 4.1.2 – Collection of System Suggestions

The system shall be capable of collecting suggestions about the system.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the Contact Us section of the site.
3. Complete the form.
4. Submit the form.
5. Log on to the RES as an Administrator.
6. Go to the Inbox
7. Verify that the information submitted with the form was sent to the Administrator.

Requirement 4.1.3 – Feedback by Contacting Administrators

The system shall provide users with the ability to contact Administrators.

This requirement is tested by inspection.

1. Visit the RES web site (logging in is not required).
2. Go to the Contact Us section of the site.
3. Complete the form.
4. Submit the form.
5. Log on to the RES as an Administrator.
6. Go to the Inbox
7. Verify that the information submitted with the form was sent to the Administrator.

Requirement 4.2.1 – Verification of Provider Information

The system shall provide the capability for Administrators to verify the user information submitted by Providers.

This requirement is tested by inspection.

1. Log on to the RES as a Consumer (Registered User).
2. Visit the Downloads section of the web site.
3. Click the “become a provider” link in the note at the top of the page.
4. Fill in all of the requested information in the form.
5. Click the Make Request button.
6. Log off of the Consumer account.
7. Log on to the RES as an Administrator.
8. Go to the Inbox.
9. Click on the message for the user requesting Provider status.
10. Verify that the Administrator is able to view the user’s information before granting him/her Provider status.

Requirement 4.2.2 – Verification of Provider through Secondary Method or Contact

The system shall provide the capability for Administrators to contact someone other than the user in order to verify the information submitted by the user.

This requirement is tested by inspection.

1. Log on to the RES as a Consumer (Registered User).
2. Visit the Downloads section of the web site.
3. Click the “become a provider” link in the note at the top of the page.
4. Fill in all of the requested information in the form.
5. Click the Make Request button.
6. Log off of the Consumer account.
7. Log on to the RES as an Administrator.
8. Go to the Inbox.
9. Click on the message for the user requesting Provider status.
10. Verify that the Administrator is able to view the name and e-mail of the secondary reference the user provided before granting the user Provider status.

Requirement 4.2.3 – Security of Sensitive Transmitted Information

The system shall be capable of transmitting sensitive information (e.g., user login names and passwords) securely.

This requirement is tested by test.

1. Visit the RES site by prepending https:// to the URL in the Location Bar of a standard browser (Mozilla Firefox, MS Internet Explorer, Safari).
2. Log on to the RES as a Consumer (Registered User).
3. Verify that the Location Bar of the browser continues show https://

Requirement 4.2.4 – Security of Stored Information

The system shall be capable of storing sensitive information securely.

This requirement is tested by inspection.

1. Log on to the machine hosting the RES.
2. Verify filesystem permissions on mainfile.php in the XOOPS_ROOT are appropriate (readable only by owner,group).
3. Verify any MySQL user with access to the RES database is password-protected.

4. Verify filesystem permissions for the MySQL database are appropriate (readable only by owner and group).

Requirement 4.2.5 – Deletion of Users for Policy Enforcement

The system shall provide the capability of deleting the accounts of users who do not comply with the policies of the system.

This requirement is tested by inspection.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the System Administration module.
4. Select the Edit Users option.
5. Verify that the option to “Delete User” exists.

Alternatively, a separate account can be made, of any type, to delete for this test. In the case that an account is available or created for deletion in this test, perform steps 1–4 above, and *instead of* step 5 above, continue from step 6 below:

6. Select the Delete User option.
7. Click the Go! button.
8. Click the Submit button to confirm the deletion.
9. Verify that the user account no longer exists in the Nicknames menu.

Requirement 4.2.6 – Protection of Private Information

The system shall maintain a user’s privacy in compliance with relevant policies.

This requirement is tested by inspection.

1. Log on to the RES as a Registered User.
2. Click Edit Account.
3. Uncheck “Allow other users to view my email address.”
4. Log out.
5. Log on to the RES as a different Registered User.
6. Go to the Downloads section.

7. Locate a download by the above user (from step 1).
8. Click the username link listed as Submitter.
9. Verify that the e-mail address is not visible.

Requirement 4.2.7 – Compliance with Other Technical, Accessibility, and Security Requirements

The system shall comply with all other relevant policies, technical or otherwise (e.g., Section 508 for accessibility).

ANALYSIS

Due to the nature of this requirement, a simple and comprehensive test cannot be written without first identifying the policies with which the RES must comply. However, these policies may vary, depending on certain factors such as the network on which the RES is hosted; if it is on a nasa.gov network, different policies may apply than if it is not. Therefore, when these policies can be identified, the RES will perform an appropriate test to verify that it complies with them. For example, in order to confirm compliance with the accessibility requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d), the web site can be run through an automated, Web-based compliance test, such as the one at <http://www.cynthiasays.com/>.

Requirement 4.2.8 – Policies Availability to Users

The system shall make all policies relevant to users publicly available to users.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Click the link to NASA's "Privacy Policy and Important Notices" that appears in the footer.
3. Verify that policies are available at the external web site.

Note: additional policies beyond those required by NASA would have to be provided in a similar fashion and their availability verified in a similar manner.

Requirement 4.3.1 – Function as a Repository

The system shall have the capability of functioning as a repository, locally storing the assets to be hosted on the system.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the web site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Click the Download button for an asset.
6. Click the I Agree button on the disclaimer page.
7. Verify that the asset file is hosted on the RES and will download directly from the RES.

Requirement 4.3.2 – Function as a Catalog

The system shall have the capability of functioning as a catalog, providing links to assets stored remotely.

This requirement is tested by demo.

1. Visit the RES web site (logging in is not required).
2. Go to the Downloads section of the web site.
3. Select any folder with assets.
4. If applicable, select any sub-folder with assets (multiple times if necessary).
5. Click the Download button for an asset.
6. Click the I Agree button on the disclaimer page.
7. Verify that the asset file is not hosted on the RES and the user is automatically directed to the external web site hosting the asset.

Requirement 4.3.3 – Selection of System Behavior by Provider

The system shall allow Providers to choose whether the system functions as a repository or a catalog for the assets they submit.

This requirement is tested by demo.

1. Log on to the RES web site as a Provider.
2. Go to the Downloads section of the web site.

3. Click Submit Download.
4. Verify that the Provider has the option of supplying the asset as a “Link to Download” or “Upload File”.

Requirement 4.3.4 – Enforcement of Asset Storage Limit

The system shall have the capability of storing individual assets of up to a maximum total size for all resources for that asset.

This requirement is tested by test.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.
3. Click on the Submit option.
4. Click the I Agree button.
5. Enter appropriate information for the following form fields:
 - a. Download Title
 - b. Upload File
 - c. Category
 - d. Description (including keywords)
 - e. Version
6. For the Upload File, choose a file that is larger in size than the allowed file size, which is displayed next to the Upload File field.
7. Click the Submit button.
8. Verify that an error page is displayed, indicating that the submission is rejected for being too big.

Note that the error page will automatically reload the download index page in a few seconds, so the tester must watch carefully for this error page to appear.

Requirement 4.4.1 – Asset Deprecation by Content Managers

The system shall provide the ability for Content Managers to deprecate assets which are no longer of interest to the community.

This requirement is tested by test.

1. Log on to the RES as a Content Manager.

2. Go to the Administration Menu.
3. Select the PD-Downloads module.
4. In the Published Files section, locate the asset to be deprecated.
5. Click the Edit This Item icon, displayed as a pencil on a sheet of paper.
6. Under “Deprecated?” click the radio button for “Yes”.
7. Click the Modify button. The module index page will be redisplayed.
8. Click on the file name of the asset just deprecated to load its page in the RES.
9. Verify that the asset is now labeled with “(DEPRECATED)” underneath its title.

Requirement 4.4.2 – Asset Removal by Administrators

The system shall provide the ability for Administrators to remove assets which no longer exist.

This requirement is tested by test.

1. Log on to the RES as an Administrator.
2. Go to the Administration Menu.
3. Select the PD-Downloads module.
4. In the Published Files section, locate the asset to be deleted.
5. Click the Delete This Item icon, displayed as a garbage/trash can.
6. Click the Delete button to confirm the deletion. The module index page will be redisplayed.
7. Verify that the file no longer exists in the Published Files list.

Requirement 4.5.1 – Verification of Data by Providers

The system shall provide the capability of offering users checksums or an equivalent, when supplied by Providers, for the purposes of data verification.

This requirement is tested by inspection.

1. Log on to the RES as a Provider.
2. Go to the Downloads section of the site.

3. Select Submit Download.
4. Verify that the form includes an option to provide a checksum.

6. Test Reports

Test reports record tests that have been performed. Each entry in the test report describes whether the test passed or failed, bug tracking references (if any), and an evaluation of the results when appropriate. Each test report sheet should reference multiple trials of the same test for easier review.

- Test Title: title/name of the test referenced by this sheet
- Date: date/time that the test was run
- Pass: Y or N to indicate if the test passed or failed
- Step: number of the step(s) that the test failed on, if applicable
- Bug: reference to a bug in an external bug tracking system (if applicable)
- System: description of the particular system, e.g., build number
- Results: actual results of the test and reason for failure, if applicable

7. Verification

Verification Methods

This section presents the requirements verification methods for the RES requirements. Four standard verification methods are planned:

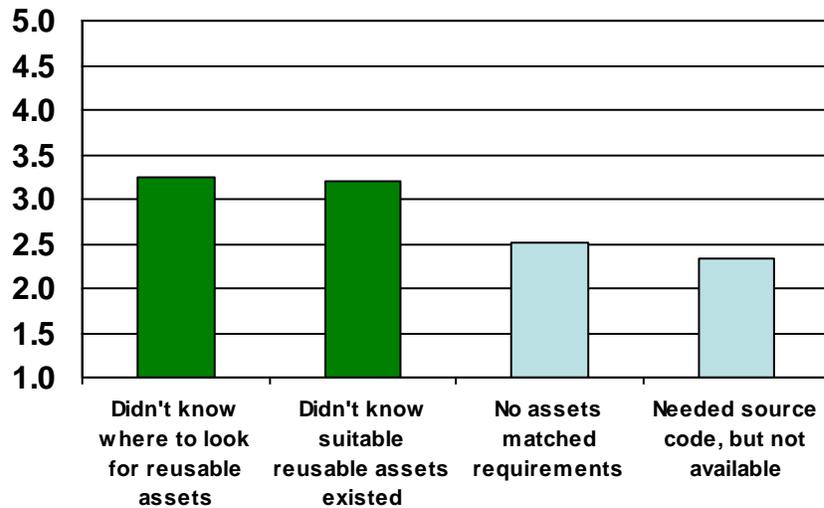
- **Inspection** – a verification method by trained individuals who look for defects using a well defined process. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets. Inspection can involve verifying interfaces and/or required standards.
- **Analysis** – a verification method that uses proven analytical techniques and/or tools to assess requirements implementation, test results, and other aspects of verification where actual operation conditions cannot be simulated adequately.
- **Demonstration** – verification method using a qualitative method to assess requirements that evaluates properties of the item by observation.
- **Test** – a verification method using a quantitative method to assess functional or performance requirements by measuring output responses to known inputs and expected results. A procedure documents inputs and expected outcomes.

See Appendix E for the accompanying verification matrix.

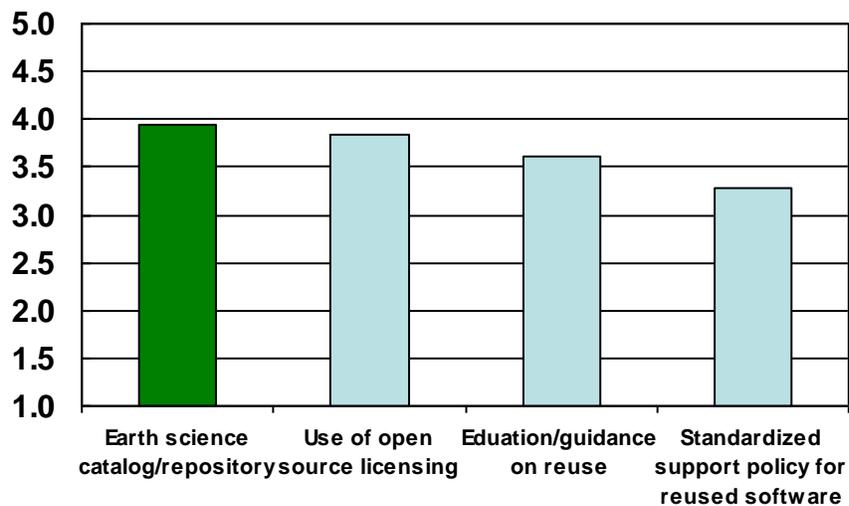
Appendix A – Software Reuse Questionnaire

The majority of the survey consisted of multiple choice questions where each listed option was ranked from 1 (not important at all) to 5 (very important). The following charts show the weighted average results for the top few responses to two of the questions.

Question 7 – How important were the following factors in preventing you from reusing software development artifacts developed outside your group?



Question 47 – In your opinion, how important would the following factors be in helping increase the level of reuse within the Earth science community?



Appendix B – Enabling Systems Recommendation

The Software Reuse Working Group previously submitted a recommendation for a Reuse Enablement System to NASA HQ. This appendix contains the content of that recommendation and HQ's response to it.

- NASA should establish a system to facilitate the cataloging and distribution of reusable assets for the Earth science community
- NASA should establish an effective mechanism for dissemination of reusable assets within the Earth science community
- NASA should evaluate the technology options for the provision of a reuse enablement system including:
 - commercial reuse catalogs/repositories
 - open source reuse catalogs/repositories
 - use of existing publicly available catalogs/repositories
 - custom build of a community-specific catalog
- Based on the conclusions of the technology evaluation, NASA should implement a reuse enablement system
- NASA should develop guidelines and standards for the management and operation of a reuse enablement system

Impact for the Working Group

- The reuse working group will evaluate the technology options for the provision of a reuse enablement system
- The reuse working group will develop guidelines and standards for the management and operation of a reuse enablement system
- The reuse working group will develop a proposal for the implementation of a reuse enablement system based on the conclusions of the technology evaluation
- One additional FTE will be required for the balance of '05 fiscal year

Desired Decision

- HQ agreement to proceed with the evaluation of technology options and to provide funding for the evaluation
- HQ agreement in principle to the establishment of a reuse catalog subject to the findings of the evaluation

Headquarters' Response

- HQ thinks such a recommendation is premature and needs to await the results of a trade study concerning the establishment of a reuse catalog

Appendix C – General Requirements

For several months in 2004, the Software Reuse Working Group collaborated to define a set of requirements for a software Reuse Enablement System serving the Earth science community. This appendix contains a list of those requirements as previously submitted to NASA HQ.

General Requirements

- The system will facilitate the distribution and reuse of software development artifacts across the Earth and space science communities
- The reusable artifacts supported by the system will include software components and other digital artifacts used in the software development process
- The system will run on industry standard hardware and operating system
- The system will support remote access through standard Internet browsers
- The system will support the automated collection of system and asset usage metrics
- The system will provide error handling for all capabilities
- The system shall be flexible to support changes in NASA policy and strategy

Search Requirements

- The system will allow users to browse and look at system content without registering
- The system will allow users to discover (search for and find) assets of interest using multiple search mechanisms (e.g., keyword search or category search)
- The system will allow search results to be ordered in a number of ways (e.g., by category or rating)

User Registration

- The system will allow new users to register with the system and the user role defined by the registration will determine the user's access authority within the system
- Each user registration will require the approval of a system administrator
- The system will allow a user to update their user profile
- The system will allow registered users to provide system feedback
- The system will allow registered users to subscribe to system or asset events including events such as new versions, updates, and comments supplied by other users

Asset Usage

- The system will allow a Consumer to acquire an asset from the system repository
- The system will allow a Consumer to register usage of an asset, indicating active usage of the asset (this is different from downloading the asset)
- The system will provide a user forum for discussion and comments on assets
- The system will allow a Consumer to provide a rating and feedback on his/her experience with a particular asset
- The system will allow posting of requests for reusable assets that currently are not in the system

Asset Submission

- The system will allow a Provider to submit a new asset profile to the system
- The Provider may optionally upload artifacts associated with the asset
- Each asset submission will require the approval of a Content Manager before it can be accessed by other system users
- The system will allow a Provider to update the information about an asset and change the artifacts associated with the asset
- The system will allow Providers to subscribe to asset events including such events as comments and new requests pertaining to their contribution

Content Management

- The system will allow users to review feedback on assets and allow the Content Manager to remove feedback on assets (e.g., to make sure comments are on topic)
- The system will allow the Content Manager to review and approve asset submissions prior to them being made available to the community
- The system will allow the Content Manager to review the assets and remove those which are no longer relevant; this includes those that have poor reviews and/or no users
- The system will allow the Content Manager to review unsuccessful searches to capture consumer demand for assets that are not registered

System Administration

- The system will allow Administrators to monitor the general operating state of the system and perform designated routine tests to determine that the system is functioning properly
- The system will allow Administrators to manage user accounts and passwords
- The system will allow Administrators to monitor user feedback and use it to determine evolutionary needs of the system and other users
- The system will allow Administrators to generate reports including metrics
- The system will send notifications to subscribed users of system issues or events

Appendix D – Glossary of Terms

Administrator – a user who controls, operates, and manages the system

Asset – an item produced at some point in the software development life cycle that is recognized as having a particular value

Catalog – a system that stores links to assets, but does not store/host the assets themselves

Consumer – a user, either registered or unregistered, who is allowed to access or otherwise use assets in the system, subject to their license terms

Content Manager – a user whose main role is to review content submitted to the system (e.g., a new asset) for appropriateness and relevance

Portal – a system that serves as a single point of access to varied information and provides a consistent look and feel for accessing that information

Provider – a registered user who has been granted permission to upload asset resources and metadata to the system

Registered user – a user who has completed a registration process in order to obtain an account on the system

Repository – a system that stores/hosts the actual assets themselves

Submit – refers to the process by which information is provided to the system for inclusion in the system

Unregistered user – a user who has not completed a registration process in order to obtain an account on the system

User – any person who accesses the system

Web site – a collection of Web pages (documents), images, etc. available on the World Wide Web

Appendix E – Verification Cross-Reference Matrix

Requirement Number and Title	Verification Method			
	Inspection	Analysis	Demo	Test
<i>1 – Users and User Information</i>	<i>N/A</i>			
<i>1.1 – Support of User Types</i>	<i>N/A</i>			
1.1.1 – Support for Consumer User	X			
1.1.2 – Support for Provider User	X			
1.1.3 – Support for Administrator User	X			
1.1.4 – Support for Content Manager User	X			
<i>1.2 – User Information Storage</i>	<i>N/A</i>			
1.2.1 – Storage of Common User Information				X
1.2.2 – Storage of Provider Information				X
<i>1.3 – User Interface</i>	<i>N/A</i>			
1.3.1 – User Profile Management	X			
1.3.2 – User Request Account Deletion				X
<i>2 – Asset Storage and Management</i>	<i>N/A</i>			
<i>2.1 – Asset Information Storage</i>	<i>N/A</i>			
2.1.1 – Storage of Asset Information				X
2.1.2 – Storage of Asset Resources				X
2.1.3 – Storage of Asset Versions				X
2.1.4 – Scanning of Asset Uploads	X			
<i>2.2 – Asset Discovery</i>	<i>N/A</i>			
2.2.1 – Display Alphabetical Listing of Assets	X			

Requirement Number and Title	Verification Method			
	Inspection	Analysis	Demo	Test
2.2.2 – Provide Search for Assets				X
2.2.3 – Display Hierarchical Navigation of Assets	X			
<i>2.3 – Asset Management</i>	N/A			
2.3.1 – Provider Registration of New Assets				X
2.3.2 – Provider Modification of Asset				X
2.3.3 – Provider Approval of Asset Modifications				X
2.3.4 – Provider Request for Asset Removal	X			
2.3.5 – Provider Categorization Asset				X
<i>2.4 – Asset Feedback</i>	N/A			
2.4.1 – Collection of Comments About Assets				X
2.4.2 – Collection of Quantitative Feedback				X
2.4.3 – User Registration of Asset Usage				X
2.4.4 – Feedback by Contacting Providers				X
2.4.5 – Display Feedback				X
<i>2.5 – Asset Metrics and Reports</i>	N/A			
2.5.1 – Collect Number of Downloads			X	
2.5.2 – Collect Number of External Links Accessed			X	
2.5.3 – Collect Number of Registered Users for Assets			X	
2.5.4 – Summarize Ratings from Quantitative Feedback				X
<i>2.6 – Asset Access Control</i>	N/A			
2.6.1 – Limit Access of Certain Users from Certain Assets				X

Requirement Number and Title	Verification Method			
	Inspection	Analysis	Demo	Test
3 – <i>Send and Manage Notifications</i>	N/A			
3.1 – <i>Send Notifications for Asset Events</i>	N/A			
3.1.1 – Send Notification on Modification of Asset				X
3.1.2 – Send Notification on Submission of New Feedback				X
3.1.2 – <i>Send Notification for System Events</i>	N/A			
3.2.1 – Send Administrative Notification for Asset Information				X
3.2.2 – Send Administrative Notification for System Information				X
3.3 – <i>Notification Management</i>	N/A			
3.3.1 – User Addition of Notifications for Assets				X
3.3.2 – User Removal of Notifications				X
4 – <i>System Operations</i>	N/A			
4.1 – <i>System Feedback</i>	N/A			
4.1.1 – Collection of System Problems	X			
4.1.2 – Collection of System Suggestions	X			
4.1.3 – Feedback by Contacting Administrators	X			
4.2 – <i>System Policies Compliance, Security, and Privacy</i>	N/A			
4.2.1 – Verification of Provider Information	X			
4.2.2 – Verification of Provider through Secondary Method or Contact	X			
4.2.3 – Security of Sensitive Transmitted Information				X

Requirement Number and Title	Verification Method			
	Inspection	Analysis	Demo	Test
4.2.4 – Security of Stored Information	X			
4.2.5 – Deletion of Users for Policy Enforcement	X			
4.2.6 – Protection of Private Information	X			
4.2.7 – Compliance with Other Technical, Accessibility, and Security Requirements		X		
4.2.8 – Policies Availability to Users			X	
<i>4.3 – Repository and Catalog</i>	<i>N/A</i>			
4.3.1 – Function as a Repository			X	
4.3.2 – Function as a Catalog			X	
4.3.3 – Selection of System Behavior by Provider			X	
4.3.4 – Enforcement of Asset Storage Limit				X
<i>4.4 – Asset Cleanup</i>	<i>N/A</i>			
4.4.1 – Asset Deprecation by Content Managers				X
4.4.2 – Asset Removal by Administrators				X
<i>4.5 – Data Integrity</i>	<i>N/A</i>			
4.5.1 – Verification of Data by Providers	X			